MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2021/2022

DME5066 – ENGINEERING MECHANICS 1: STATICS

(Diploma in Engineering)

12 AUGUST 2022

9.00 a.m.– 11.00 a.m.

(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 8 pages including the cover page.
2. Choose FOUR questions to answer.
3. The distribution of the marks for each question is given.
4. Please write all your answers in the answer booklet provided. All necessary workings **MUST** be shown.

Question 1

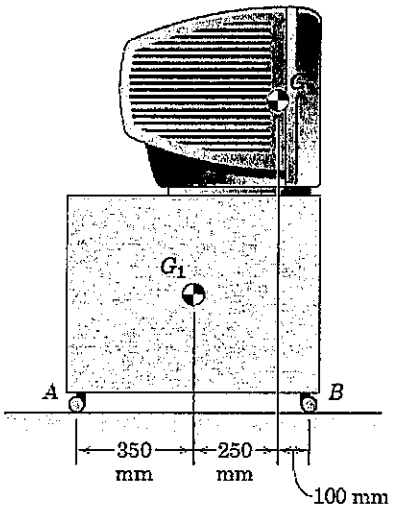


Figure 1

(a) Figure 1 shows a 75-kg old television rested on a 25-kg cabinet. The mass centers are labeled as G1 and G2. Determine the force reactions at A and B. Hint: The mass center of most television is located well forward because of the heavy nature of the front portion of the picture tube. [12 marks]

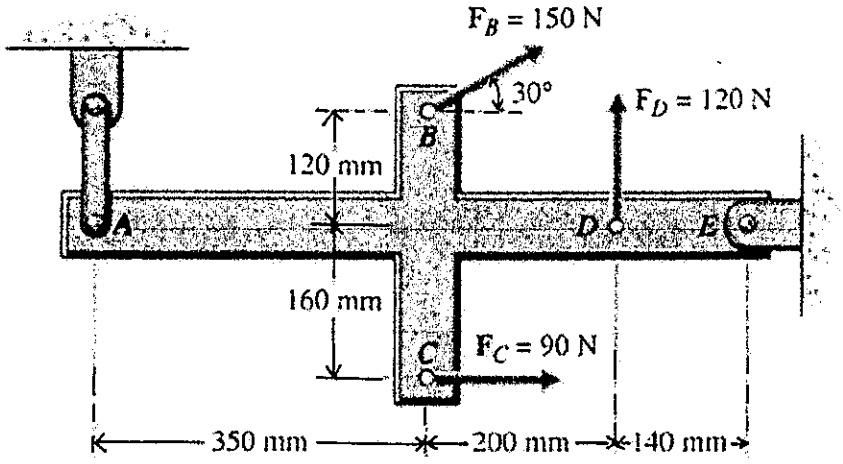


Figure 2

(b) Three forces are applied to a bracket as shown in Figure 2. Determine,
i) the moment of force F_C about point B
ii) the moment of force F_D about point A
iii) the moment of force F_B about point C. [13 marks]

Continued...

Question 2

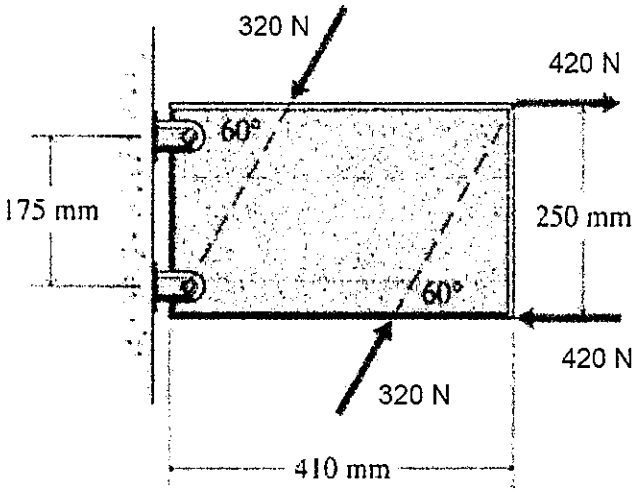


Figure 3

a) A plate is loaded with a system of forces as shown in Figure 3. Calculate the total moment of the system. [12 marks]

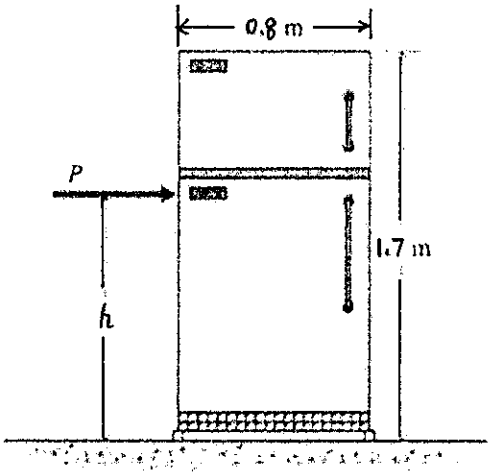


Figure 4a

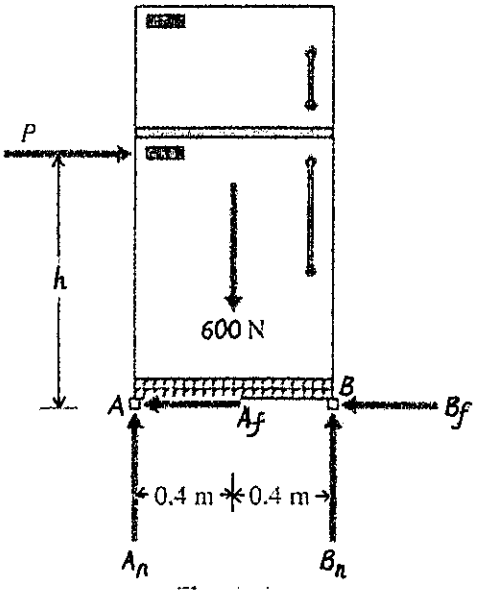


Figure 4b

b) Figure 4a shows a refrigerator where its wheels are stuck and will not move. Figure 4b is the free body diagram of the refrigerator. The refrigerator weighs 600 N. Assume the coefficient of friction between the refrigerator and the floor is 0.6,

Continued...

determine

i) the force necessary to cause the refrigerator to just start to move

ii) the maximum height h at which the force can be applied without causing the refrigerator to tip over. [13 marks]

Question 3

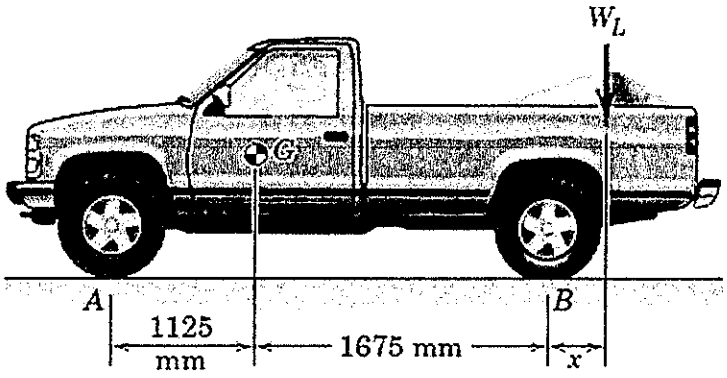


Figure 5

a) Figure 5 shows the center of mass of a 1600-kg pickup truck in unladen condition. If a load whose center of mass is x = 420 mm behind the rear axle is added to the truck, determine the mass for which the normal forces under the front and rear wheels are equal. [12 marks]

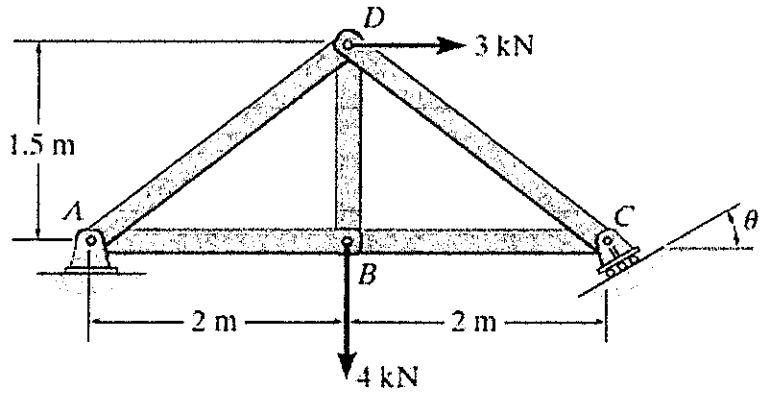


Figure 6

b) Refer to Figure 6. By using method of joint, and taking analysis at joint C, determine the force F_{CD} and F_{CB}. For this question, set θ = 30

[13 marks]

Continued...

Question 4

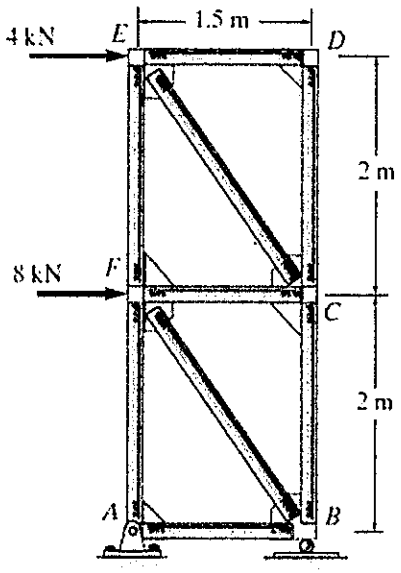


Figure 7

a) Determine the force in members EF, CF and BC as shown in Figure 7, and state if the members are in tension or compression. [12 marks]

b) Figure 8 shows a composite area. Locate the x-coordinate of the centroid. [13 marks]

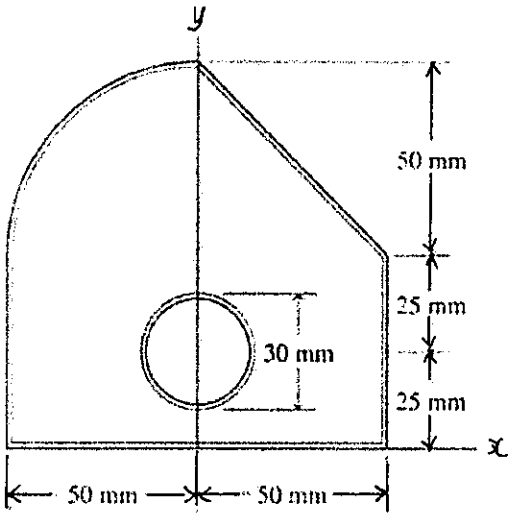


Figure 8

Continued...

Question 5

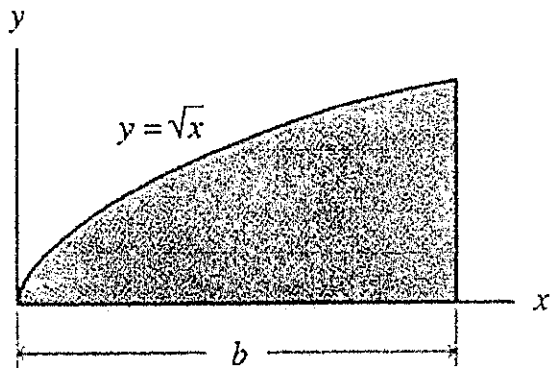


Figure 9

(a) Locate the y-coordinate of the centroid of the shaded area as shown in Figure 9. [12 marks]

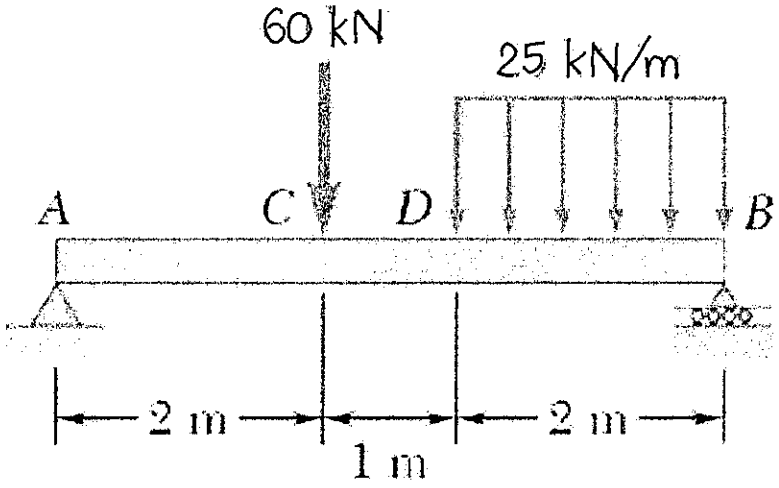


Figure 10

b) Figure 10 shows the beam and loading. Determine the shear and moment from A to C, and from C to D. [13 marks]

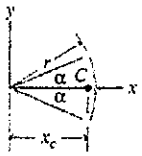
CENTROID LOCATIONS FOR A FEW COMMON LINE SEGMENTS AND AREAS

Circular arc

$L = 2r\alpha$

$x_C = \dfrac{r \sin \alpha}{\alpha}$

$x_C = 0$

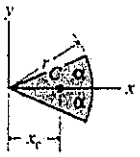


Circular sector

$A = r^2\alpha$

$x_C = \dfrac{2r \sin \alpha}{3\alpha}$

$y_C = 0$

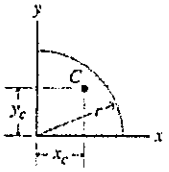


Quarter circular arc

$L = \dfrac{\pi r}{2}$

$x_C = \dfrac{2r}{\pi}$

$y_C = \dfrac{2r}{\pi}$

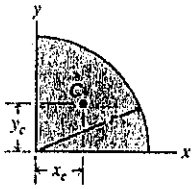


Quadrant of a circle

$A = \dfrac{\pi r^2}{4}$

$x_C = \dfrac{4r}{3\pi}$

$y_C = \dfrac{4r}{3\pi}$

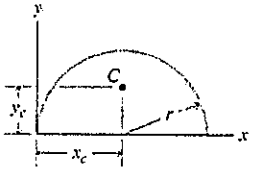


Semicircular arc

$L = \pi r$

$x_C = r$

$y_C = \dfrac{2r}{\pi}$

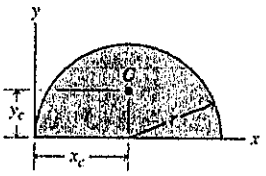


Semicircular area

$A = \dfrac{\pi r^2}{2}$

$x_C = r$

$y_C = \dfrac{4r}{3\pi}$

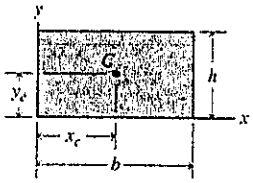


Rectangular area

$A = bh$

$x_C = \dfrac{b}{2}$

$y_C = \dfrac{h}{2}$

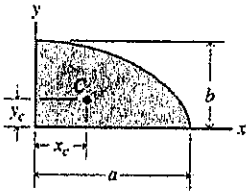


Quadrant of an ellipse

$A = \dfrac{\pi ab}{4}$

$x_C = \dfrac{4a}{3\pi}$

$y_C = \dfrac{4b}{3\pi}$

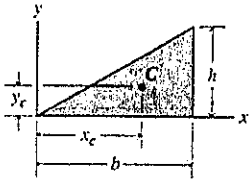


Triangular area

$A = \dfrac{bh}{2}$

$x_C = \dfrac{2b}{3}$

$y_C = \dfrac{h}{3}$

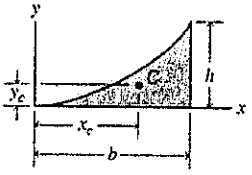


Parabolic spandrel

$A = \dfrac{bh}{3}$

$x_C = \dfrac{3b}{4}$

$y_C = \dfrac{3h}{10}$

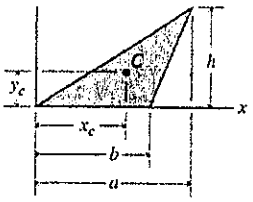


Triangular area

$A = \dfrac{bh}{2}$

$x_C = \dfrac{a + b}{3}$

$y_C = \dfrac{h}{3}$



Quadrant of a parabola

$A = \dfrac{2bh}{3}$

$x_C = \dfrac{5b}{8}$

$y_C = \dfrac{2h}{5}$

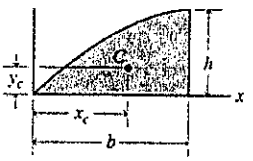


TABLE 5-2 CENTROID LOCATIONS FOR A FEW COMMON VOLUMES

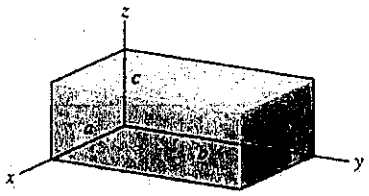
Rectangular parallelepiped

$V = abc$

$x_C = \frac{a}{2}$

$y_C = \frac{b}{2}$

$z_C = \frac{c}{2}$



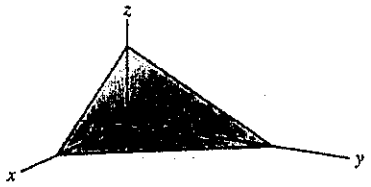
Rectangular tetrahedron

$V = \frac{abc}{6}$

$x_C = \frac{a}{4}$

$y_C = \frac{b}{4}$

$z_C = \frac{c}{4}$



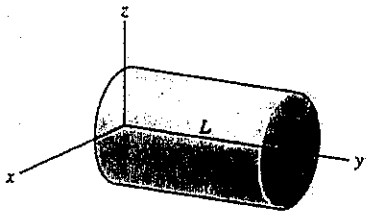
Circular cylinder

$V = \pi r^2 L$

$x_C = 0$

$y_C = \frac{L}{2}$

$z_C = 0$



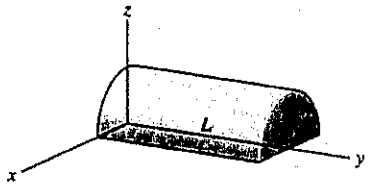
Semicylinder

$V = \frac{\pi r^2 L}{2}$

$x_C = 0$

$y_C = \frac{L}{2}$

$z_C = \frac{4r}{3\pi}$



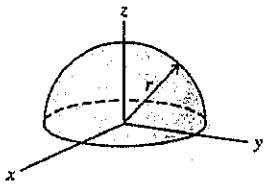
Hemisphere

$V = \frac{2\pi r^3}{3}$

$x_C = 0$

$y_C = 0$

$z_C = \frac{3r}{8}$



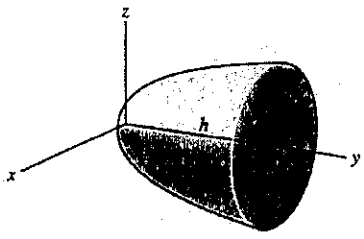
Paraboloid

$V = \frac{\pi r^2 h}{2}$

$x_C = 0$

$y_C = \frac{2h}{3}$

$z_C = 0$



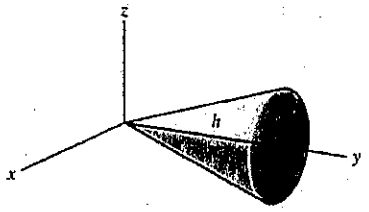
Right circular cone

$V = \frac{\pi r^2 h}{3}$

$x_C = 0$

$y_C = \frac{3h}{4}$

$z_C = 0$



Half cone

$V = \frac{\pi r^2 h}{6}$

$x_C = 0$

$y_C = \frac{3h}{4}$

$z_C = \frac{r}{\pi}$